Synopsis of the thesis

TECTONO-GEOMORPHIC EVOLUTION OF THE PENGANGA RIVER BASIN, MAHARASHTRA, INDIA

Submitted By

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(M.Sc., P.G.D.G.I., M.Phil.)

Proposed to be submitted

In Partial fulfillment of the requirements for the degree of

DOCTOR OF PHILOSOPHY

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SWAMI RAMANAND TEERTH MARATHWADA UNIVERSITY NANDED

2017

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Abstract:

An investigation of tectonic control with the help of morphometric parameters have been discussed in M.Phil. thesis of the area around Kinwat lineament. The thesis has shown a light on how anomalous sites are helpful to see the hidden structures based on remote sensing imageries. As remote sensing datasets are good indicators to find out the hidden structures, as it reflected in imageries and as well as in morphometry. The morphometric analysis is the study of the landforms produced by various processes. The morphometry is important tool to characterize and to understand the evolution of landforms. The study of the morphometry can be done statistically by processing the datasets in the GIS platforms. The present study formulated to show the evolution of the Penganga River basin based on morphometric parameters. The Penganga ricer forms the 'S' alphabetic like course. The question arises whether this "S" type development is normal with general trend of the reason or it has been controlled tectonically or neo-tectonically? This can be answered when checked with Geomorphic Indices for Active Tectonics (GAT). If active, the morphometric analysis combined with GAT will show the neo-tectonism or anomalous behavior of the basins. Further prone basins/ sites are likely to visit. The study will also be attempted to check tectonic deformations in the field and will also be attempted to differentiate.

1. Introduction

The geomorphology is the branch of geology that deals with the study of landforms. This generally includes the development of the landforms and the history of surface changes, while the internal processes are responsible for surfacial processes that have reflected in the crust. Tectonic geomorphology is the study of landforms that result from internal processes of earth. the surfacial features of the crust generally reflect the internal processes active below the crust and mantle. The reglection of these processes is expressed in the crust by geological structures like 'Faults', 'Lineaments', 'Folds', 'joints', 'intrusion', 'volcanism' etc. the crust is modified to large extent by these processes. However, at the same time these features are degraded due to surface processes by weathering and erosion in particular. The study of these two braches i.e. geomorphology and tectonics is developed as 'morphotectonics'. The river Penganga forms its basin in the Maharashtra state and is a tributary of Wardha River. The confluence of Wardha River and Penganga River is found nearby town Ghughus of Chandrapur district. The river has its catchment in Buldhana district and its discharge to

Chandrapur district. The river is flowing from Buldhana to Washim and is referred as boundary in between Washim, Hingoli, Nanded, Yeotmal and Chandrapur districts. The basin is formed in the Deccan plateau and continued through it till it reaches the Granites of Eastern Dharwarian Craton. The present river is forming its "S" alphabetic like shape in between Nanded and Yeotmal districts. This "S" shape trend of the river is formed in between the two lineaments, viz. Kinwat Lineament and Ambari Lineament. The stretch of these linear trends is roughly 15.6 km and 28 km based on Google earth data. Both linear structures are trending NW – SW and hinting towards that could have been formed by structurally controlled. the morphometrical analysis talks about neotectonism and the sites are further intended to check for some indicators of deformations. The Kinwat lineament has been reported in mu M.Phil thesis 2016 and its maximum part is covered by the three sub-basins. These three sub-basins shown the tectonic control and are completely covered by soils and alluviums. the deformation we found in sub-basin no. 14.

2. Review of Literature

Earlier, the manual techniques have been used to calculate the geometry of the landscape (Hortan, 1945; Miller, 1953; Coates, 1958). The measurement of these parameters through toposheets is time consuming. In 1960s and early 1970s, the availability of computers made it possible to identify landscape features based on statistical methods. (Chorley, 1972; Evans, 1972). The present study area is covered by Deccan Basalts and Eastern Dharwar Craton. The Deccan Basalts is extended up to near Kinwat and Eastern Dharwar Craton continues from Kinwat up to confluence with Wardha River. The present study is an extended pat of M.Phil. thesis.

Quantitative and qualitative analysis of landscapes and identification of regions experiencing tectonic deformation was made possible by using geomorphic indices (Keller and Pinter, 1996). These approaches numerically define land surface parameters, and therefore have been successfully applied by scientists in order to identify and characterize the landscape of active tectonics. (Strahler. 1952; Pike, 1995, 2000; Chen et al., 2003; Rasemann et al., 2004; Molin et al., 2004; El Hamdouni et al., 2008; Troiani and Della Seta, 2008; Pedrera et al., 2009; Pérez-Peña et al., 2009a, 2010; Font et al., 2010; Giaconia et al., 2012; Mahmood and Gloaguen, 2012; Gioia et al., 2014; Giachetta et al., 2015; Manoj et al., 2016). The feomorphology can offer structural geology as the role in drainage pattern in controlling the landforms and interpretation of drainage pattern. most river pattern can be determined by geological structures and slopes and some of the anomalies can be caused by active faults and folds (Twidale 2004). The control of drainage pattern by geological structures is widely accepted now. (Burnett &Schumm 1983; Ouchi 1985; Mather 1993; Jakson et al. 1998; Zelilidis 2000; Maynard 2006; Hodgkinson et al 2007)

The zones of rock weakness or rotation of fault blocks is the zones of preferential rock weathering and erosion along faults or beds which are folded. Linear trends of major drainage channels, steep slopes may be used to identify zones of faulting. Analysis of such drainage pattern and recognition of anomalies inside these drainage systems have been widely used nowadays to identify hidden geological structures and neotectonism. (Jackson et al. 1998; Goldsworthy & Jackson 2000; Burrato et al. 2003; Vannoli et al. 2004; Delcaillau et al. 2006; Hodgkinson et al. 2006a; Hodgkinson et al 2007).

The Kinwat area has been reported in terms of petrography and petrochemistry focusing radioactive minerals by Rahul Banerjee et al (2010). His findings concluded that the Kinwat area is occupied by Deccan Basalts and ancient granite. And also shows Crystalline Inlier that is predominantly represented by two distinctive suits of granitoids, viz. pink and grey granites belongs to same felsic and hybrid granitoids. (Banerjee et al 2010). Raychaudhari et al (1976) suggests the small outcrops of Precambrian metamorphic rocks are found along the eastern part of Penganga River.

3. Objectives Proposed

1. To document and delineate Quaternary Stratigraphy and geomorphology of the Penganga river basin.
2. To study the Morphotectonic attributes of the basin with specific focus on GAT.
3. To study tectonic control sedimentation.
4. To study deformation of sediments due to Neotectonics including Seismic Induced Activity.

4. Methodology adopted

The following methodology will be adopted to work out neotectonic and geomorphic evolution of the Penganga river basin.

1. Collection and appraisal of literature relevant to the present study. A critical review of the available geologic and structural information and geophysical data will be done to understand the overall geologic setup of the area in a regional context.
2. Lineaments and mega-geomorphic features will be identified using satellite data which will also help in identification of sites or segments of importance.
3. The various landforms and Quaternary geomorphic and fluvial features like terraces will be mapped in the field. Special emphasis will be placed on delineating the geomorphic setting of the Quaternary sediments for delineating control of tectonics on sedimentation and erosional episodes.
4. Detailed field mapping of Quaternary sediments will be carried out by preparing vertical lithologs of the sediments exposed along the incised cliffs and lateral facies mapping. A

composite lithostratigraphy of the Quaternary sediments of Penganga basin will be reconstructed based on presence and identification of key horizons/markers.

5. The exposed Quaternary sediments will be investigated in details for evidence of tectonically and seismically induced sediment deformation and assign them to specific causative events. Sequence of Quaternary tectonic movements leading to the development of present landscape will be reconstructed based on geomorphic, stratigraphic and other field criteria.
6. Detailed geomorphic and drainage analysis will be carried out using parameters known to be sensitive to tectonics, to decipher the role of lineaments and faults on the geomorphic setup and fluvial architecture.
7. The data generated in the field and lab will be critically evaluated and synthesized reconstruct a model of Quaternary geology and geomorphology of the Penganga river basin.
8. The satellite data will be used to plot the Digital Elevation Model of the study area.

Morphometric analysis of the basin brings out necessary information about the landform and gives indication about landform activity in present and past. In the present study, Toposheet, Google earth imageries, and satellite borne ASTER data will be utilized for generation of database and extraction of various drainage parameters. The morphometric parameters such as stream order, stream segments, drainage pattern, sub-basin area, length, perimeter can be performed from ASTER DEM data and verified with Survey of India topographical map (1:50,000). The Geomorphic Indices for Active Tectonics (GAT) are Asymmetric Factor, Hypsometric Integral, Elongation Ratio, Drainage Density and Stream Frequency will be then calculated using mathematical equations so extracted by GIS environment. The field measurements will be made using clinometers, measuring tape, Camera, Global Positioning System (GPS), hammer, chisel, glasses, haversack, etc. All measurements are then recorded in field notebook.

5. Importance of study

a. International

This study brings out the fact of evolution of Penganga river either it is of normal or it is of neotectonic/tectonic nature.

b. National

The Geomorphic Indices for Active Tectonics is planned to implement on to the study region to bring out the fact that the study has its relation with active tectonics and structures it developed.

c. Significance of the study

The study brings out morphometry of the region and its relation to the structures that developed.

The study further builds awareness about formation of kink points lying in the region. The study also reveals how morphometry helps in identifying the hidden structures and identification of landforms.

6. Proposed work plan

The Remote Sensing techniques could be used for identifying the study region. The Image Interpretation is then applied to identify the study region with Google Earth Imageries. These Google Earth imageries are nowadays very popular in providing coarser and sharper imageries that could easily available and could accessed freely. Based on these imageries preliminary surveys are to be planned and could identify accessible sites in the study region. Then Geoprocessing could be done with the help of Geographic Information System (GIS) that brings the morphometrical information of the region. Further the region could be scanned for anomalous sites and is can be attempted to visit. The visits are then intended to find tectonic or neotectonic structures. All features are then interrelated in sense to bring out the hidden facts.

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